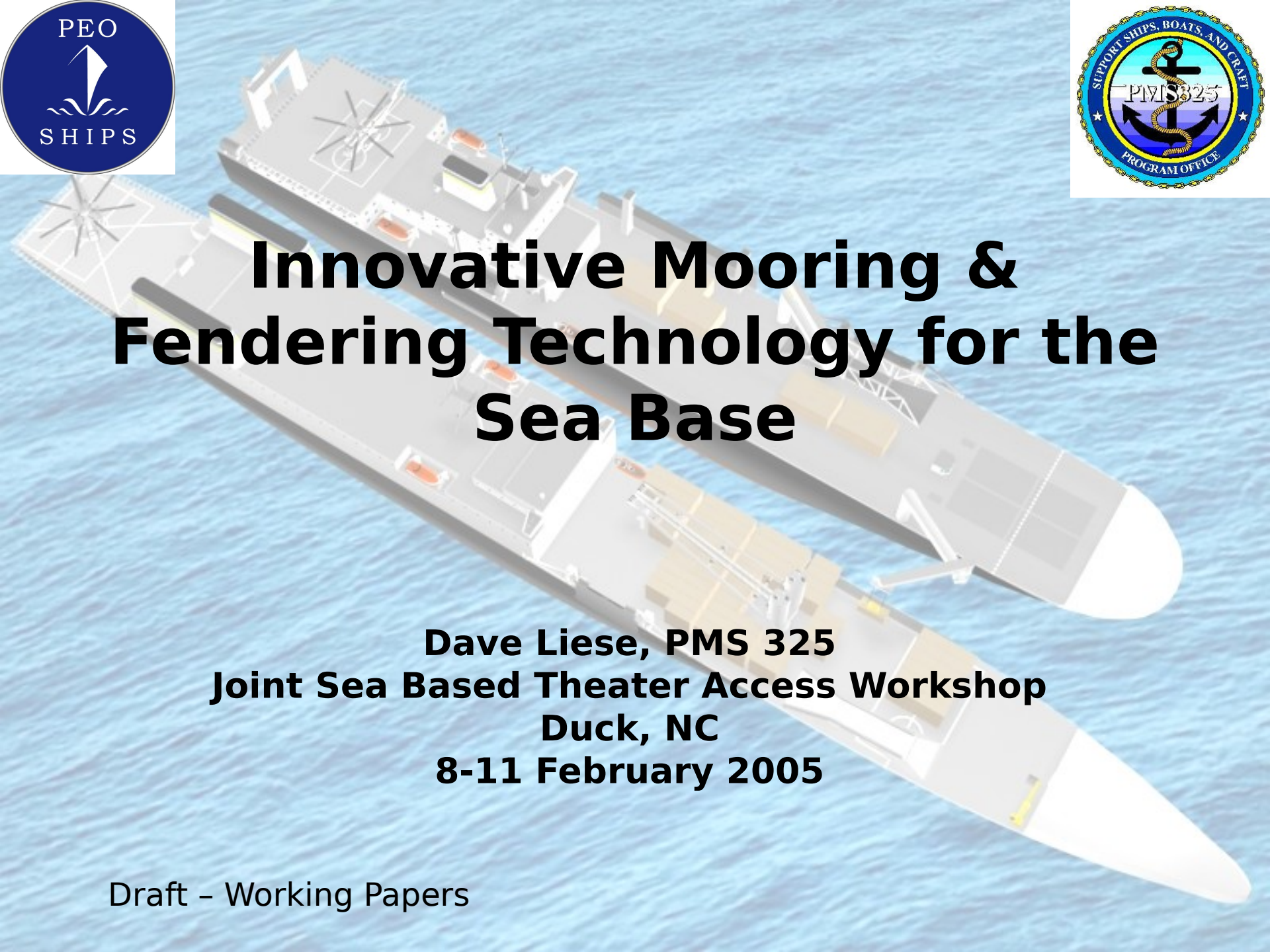


Innovative Mooring & Fendering Technology for the Sea Base

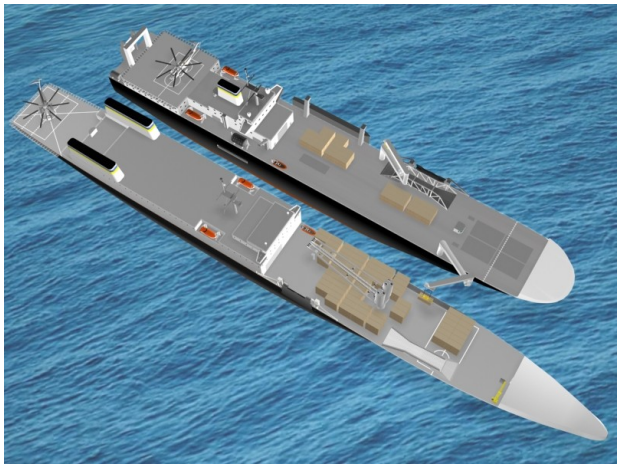
Dave Liese, PMS 325

Joint Sea Based Theater Access Workshop
Duck, NC
8-11 February 2005

Draft – Working Papers

CHALLENGE

- Sea Base requires innovative technologies for transfer of cargo in open ocean environment
- Commercial technologies have been developed that provide at-sea mooring and limited cargo transfer capabilities that may prove useful for the sealift to Sea Base interface



The Dynamic Positioning as Enabling Technology

- A partial solution to the at sea cargo transfer problem may be found using Dynamic Position Systems

- Dynamic Positioning Systems utilize ship position sensors in combination with automated computer control of multiple thrusters to maintain position relative to one another

Dynamic Positioning Advantages

- Proven technology used in the offshore industry to transfer breakbulk and liquid cargo between platforms and supply vessels
- Permits alongside cargo transfer operations without forward motion
- Eliminated need for complex fendering and mooring systems
- Approved by the USCG for transfer of HAZMAT and oil in the Gulf of Mexico

Dynamic Positioning Advantages (cont)

- Accommodates a wide variety of hull forms
- Provides for quick emergency breakaway
- Allows heading selection to minimize motions or power consumption
- Readily allows adjustment of relative position between ships, allowing greater crane access
- Mature technology – numerous vendors have developed and fielded equipment

Elements of Dynamic Positioning

Sensors – GPS or laser position measurement, wind speed and direction, and gyrocompass

(INPUT)

Control system – Computer incorporating sensor input and dynamic model of ship and directing thrusters

(OUTPUT)

Power Generation and Distribution

Thrusters (tunnel or drop-down), propellers and rudders, or any combination

Dynamic Positioning History

- 1960’s – DP **first employed** for off-shore exploration in deep water
- 1970’s - DP begins to be used to control position, heading and forward motion of **cable and pipe-laying vessels**
- 1980’s - DP equipped **shuttle tankers** are used as an alternative to pipelines in the North Sea
- 1990’s - **Supply vessels** begin using DP as an alternative to mooring lines and fenders when transferring cargo to off-shore platforms
- 1990’s - **MSC / USN** also employs DPS on T-AGS 60 Class and AGOR 23 Class vessels respectively
- 2003 - **U.S. Coast Guard approves** use of DP during oil and HAZMAT transfers in the Gulf of Mexico, eliminating requirement for mooring lines or fenders

Dynamic Positioning Applications

DP is currently used on board numerous vessels

Offshore supply vessels

Offshore Drilling and Exploration

Shuttle tankers and Floating Production, Storage, Offloading (FPSO) vessels

Offshore Construction Derricks

Cruise Ships

Dynamic Positioning Applications (concluded)

Diver Support Ships

Research Vessels

Two new Classes of USCG Buoy Tender

Pipe Laying Ships and Derricks

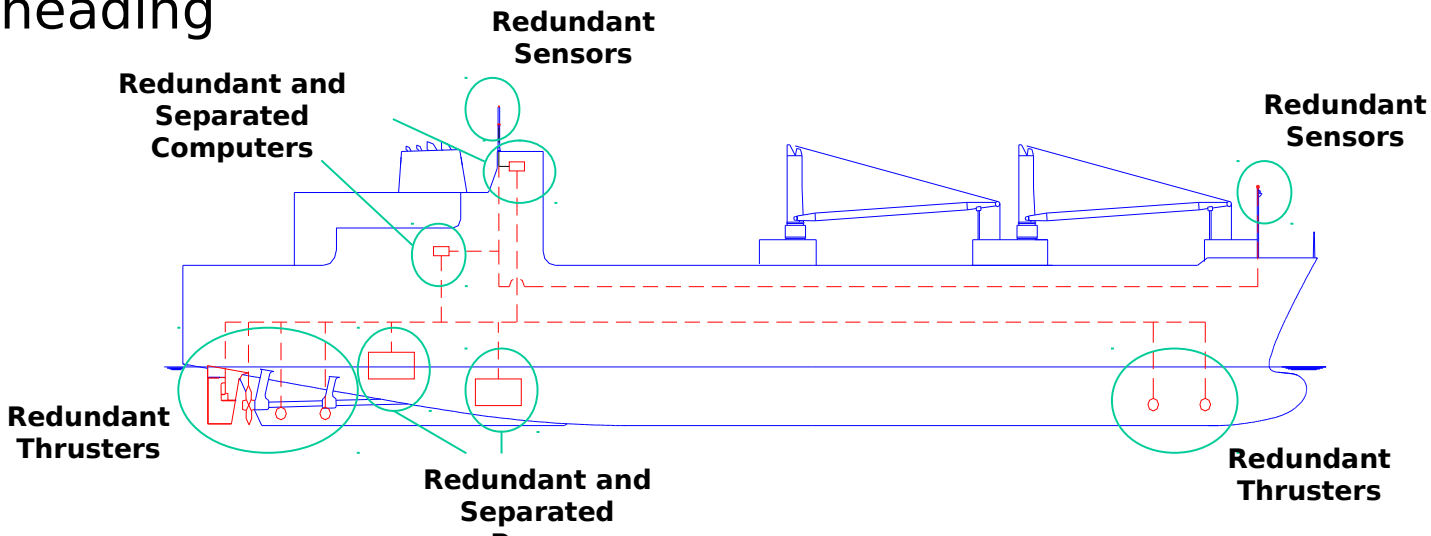
Dynamic Positioning System Classifications*

- Class 1 DPS - Loss of position may occur due to a single fault (not approved by USCG for offshore supply)
- Class 2 DPS - Redundant/No loss of ship's position due to single fault in any active component or system
- Class 3 DPS – Redundant with Separation/No loss of ship's position due to single fault in any component or system due to fire or flooding of any single watertight compartment

* As defined in IMO Resolution A.

Necessary DP Features for Sealift to Seabase Cargo Transfer

- Level 3 DPS (fully redundant and separated components)
- Sized to maintain position in sea state 4 (threshold) with spiral development to sea state 5 (goal)
  - In order to operate in sea state 4 and above, these thruster systems may have power requirements approaching that of the propulsion system
- Position control accurate enough to maintain relative location between vessels
- Heading control accurate enough to maintain selected heading



QUESTIONS?